Richmond Lake

Site Description

Location

Water designation number (WDN)	03-0008-00
Legal description	T124N-R64W-Sec.1,12,13,14,25,36 T125N-R65W-Sec.19,22,23,24,25
County (ies)	Brown
Location from nearest town	5 miles north and 4 miles west of Aberdeen

Survey Dates and Netting Information

Survey dates	August 9-11, 2011 (FN, GN) September 26, 2011 (EF-WAE)
Frame net sets (n)	18
Gill net sets (n)	6
Electrofishing-WAE (min)	60

Morphometry

Watershed area (acres)	103,128
Surface area (acres)	829
Maximum depth (ft)	29
Mean depth (ft)	15

Ownership and Public Access

Richmond Lake is an impoundment managed by the SDGFP. Two main public access sites are present on Richmond Lake; these are located on the south (recreation area) and southeast (spillway access) shorelines and are maintained by the SDGFP (Figure 2). Richmond Lake is managed by the State of South Dakota and lands adjacent to the lake are under state and private ownership.

Watershed and Land Use

The Richmond Lake watershed is a sub-watershed within the Moccasin Creek watershed and is predominately comprised of agricultural lands with a small municipality (Leola) being located in the northwestern portion of the watershed. Much of the shoreline of Richmond Lake is rimmed with homes and cabins which are connected to a central sewer collection system (McLaury 2006).

Water Level Observations

Water levels on Richmond Lake are not monitored by SDDENR.

Aquatic Nuisance Species Monitoring

Plant Survey

Areas of emergent vegetation, primarily bulrush and cattail, are limited to the upper arms and protected bays of the impoundement. In 2011, the only submersed aquatic plant species identified was sago pondweed. No aquatic nuisance plant species were encountered.

Shoreline Survey

No aquatic nuisance species were identified in 2011.

Fish Community Survey

Common carp was the only aquatic nuisance fish species captured in 2011.

Fish Management Information

Primary species	black crappie, bluegill, walleye
Other species	black bullhead, channel catfish, common carp, green sunfish, largemouth bass, northern pike, pumpkinseed, rock bass, smallmouth bass, spottail shiner, white bass, white sucker, yellow perch
Lake-Specific regulations	Largemouth/Smallmouth Bass: minimum length 15” Walleye: minimum length 15”
Management classification	warm-water permanent impoundment
Fish Consumption Advisories	none

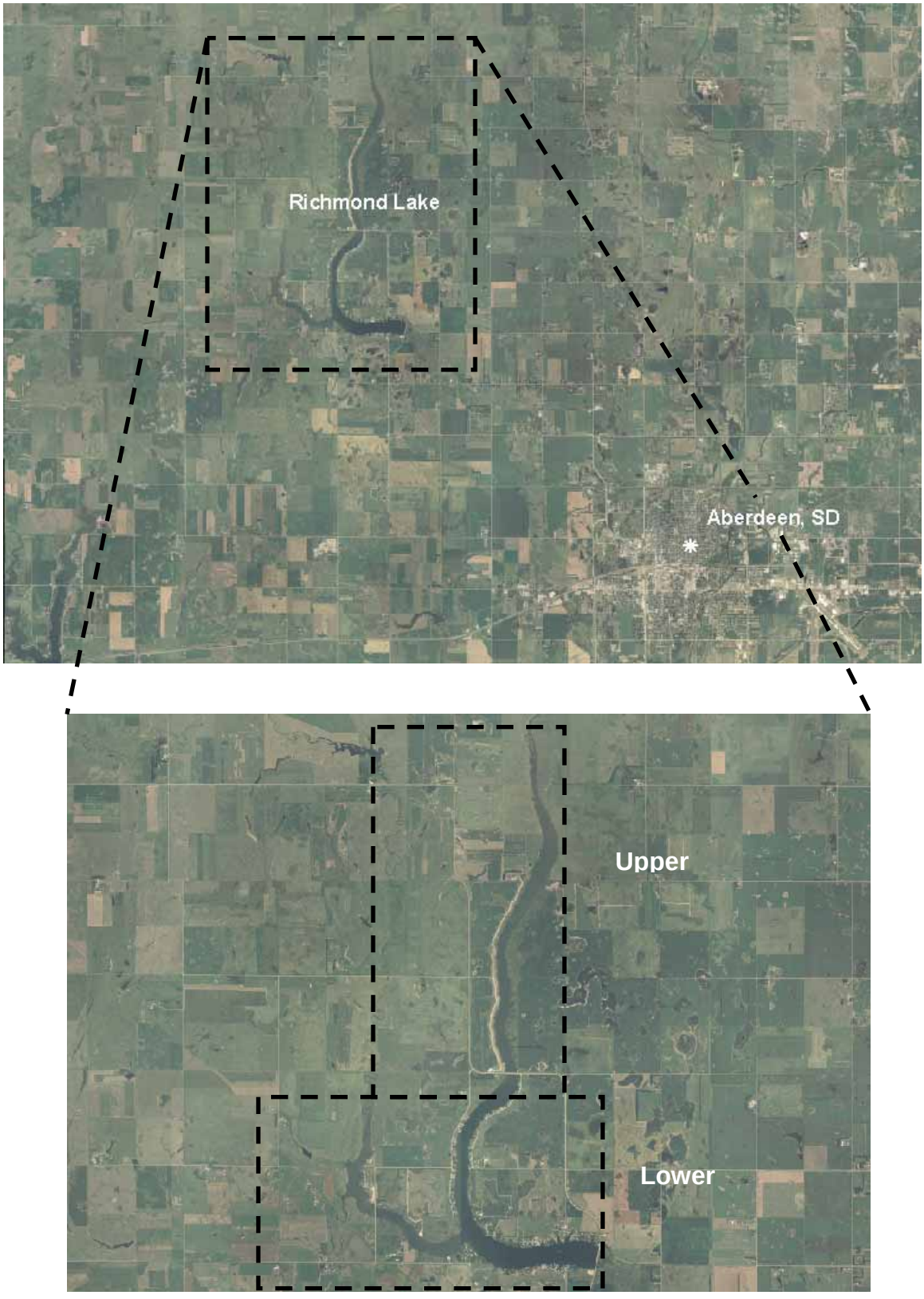

Figure 1. Map depicting location of Richmond Lake from Aberdeen, Brown County, South Dakota, and upper/lower divisions.

Figure 2. Map depicting access points and standardized net locations for Richmond Lake, Brown County, South Dakota. RMFN= frame nets, RMGN= gill nets

Management Objectives

1) Maintain a frame net mean CPUE of stock-length black crappie ≥ 10, a PSD of 30-60, and a PSD-P of 5-10.

2) Maintain a frame net mean CPUE of stock-length bluegill ≥ 25, a PSD of 30-60, and a PSD-P of 5-10.

3) Maintain a gill net mean CPUE of stock-length walleye ≥ 20, a PSD of 10-40, and a PSD-P of <5.

4) Maintain a frame net mean CPUE of stock-length bullhead ≤ 100.

Results and Discussion

Richmond Lake is an impoundment located 5 miles north and 4 miles west of Aberdeen, SD. Richmond Lake was constructed by the damming of Foot Creek in the 1930's by the Works Progress Administration. Foot Creek (west arm) and an unnamed tributary (north arm) are the major surface water inlets to Richmond Lake. Water exits Richmond Lake through an outlet on the east side of the lake flowing into Foot Creek and eventually draining into the James River (McLaury 2006).

Currently, Richmond Lake is managed as a bluegill, black crappie, and walleye fishery. Overall, as many as 16 species of fish have been collected from Richmond Lake.

Primary Species

Black crappie: A substantial die-off of black crappie, the cause of which is largely unknown, occurred in Richmond Lake during the summer of 2010. As a result, few adult black crappies were captured in the 2010 frame net catch (Table 2). In 2011, the mean frame net CPUE increased to 5.9 (Table 1), but remained below the minimum objective (≥ 10 stock-length crappie/net night; Table 3).

Length-frequency analysis indicated that black crappie captured in the 2011 frame net catch ranged in total length from 13 to 20 cm (5.1 to 7.9 in) and suggested the presence of two year classes, likely young (i.e., ≤ age 2) black crappie produced following the 2010 die-off (Figure 3). The 2011 PSD of 23 and PSD-P of 2 were below management objectives of 30-60 and 5-10, respectively (Table 1; Table 3).

No age and growth information was collected during 2011; however, sampled black crappie had mean Wr values that were near or above 100 for length categories (i.e., stock to quality) sampled with the mean Wr of stock-length black crappie being 99 (Table 1). No length-related trends in condition were apparent in 2011.

Bluegill: The mean frame net CPUE of stock-length bluegill was 60.7 (Table 1) and above the minimum objective (≥ 25 stock-length bluegill/net; Table 3). Since 2003, bluegill relative abundance in Richmond Lake has fluctuated from a low of 23.8 (2005) to a high of 60.7 (2011) stock-length bluegill/net night (Table 2). Based on the mean frame net CPUE, relative abundance appears to be high.

Bluegill captured in the frame nets ranged in total length from 8 to 22 cm (3.1 to 8.7 in), had a PSD of 89 and a PSD-P of 6 (Figure 4). The 2011 PSD was above the objective range of 30-60; while the PSD-P was within the objective range of 5-10 (Table 3).

Otoliths were collected from a sub-sample of bluegill in the 2011 frame net catch. Age structure information indicated the presence six year classes (2005-2010; Table 4). Year classes produced in 2008 and 2009 were the most represented and comprised 60% and 23%, respectively, of bluegill in the frame net catch (Table 4). Bluegill from the 2007 year-class had a weighted mean length at capture of 160, 189, and 198 mm (6.3, 7.4, and 7.8 in) at ages 2, 3, and 4 (Table 5). Bluegill from the 2008 year-class had a weighted mean length at capture of 161 and 182 mm (6.3 and 7.2 in) at ages 2 and 3 (Table 5). The 2009 year class had a weighted mean length of capture at age 2 of 158 mm (6.2 in; Table 5).

Bluegill in the frame net catch exhibited a slight decreasing trend in condition as total length increased; however, mean Wr values remained above 100 for all length categories (i.e., stock to quality) sampled. Condition of bluegill, as indexed using Wr values may have been influenced by spawning activity during 2011, as sampling took place during mid-summer.

Walleye: The mean gill net CPUE of stock-length walleye was 8.3 (Table 1) and below the minimum objective (≥ 20 stock-length walleye/net night; Table 3). Since 2003, gill net mean CPUE values have ranged from a low of 1.5 (2008) to a high of 26.2 (2003; Table 2). The gill net CPUE represented an increase from the 5.2 observed in 2010 (Table 2); however, relative abundance remained moderate.

Walleye captured in gill nets ranged in total length from 12 to 63 cm (4.7 to 24.8 in), had a PSD of 30 and a PSD-P of 2 (Table 1; Table 3; Figure 5). The PSD was within the management objective of 30-60; while the PSD-P was below the management objective of 5-10 (Table 3). In 2011, 26% of walleye in the gill net catch exceeded the 381 mm (15-inch) minimum length restriction (Figure 5).

The Richmond Lake walleye population has relied on large fingerling stockings to establish year-classes (Table 6; Table 8; Kaufman et al. 2008). In 2011, otoliths were collected from a sub-sample of walleye in the gill net catch and indicated the presence of five year classes (Table 6; Table 8). All year classes, except the 2011 year class (age-0 walleye present prior to large fingerling stocking) coincided with large fingerling stockings (Table 6; Table 8). The 2008 year class was the most represented and comprised 65% of walleye in the gill net catch. The presence of two age-0 walleye in the gill net catch and a mean fall night electrofishing CPUE for age-0 walleye of 34.0 indicated successful walleye reproduction in 2011 (Table 1; Table 6). In addition, 15,240 large fingerling walleye were stocked during Fall 2011 (Table 8). Recruitment of the 2011 year class is currently unknown and will be assessed in future surveys.

Growth rates can be influenced by the length at which large fingerlings are stocked into Richmond Lake as the size of stocked fish can vary greatly from year to year. Walleyes typically achieve 381-mm (15-inch) during their fifth growing season at age-4+ (Table 7). Since 2007, the weighted mean total length at capture of age-3 walleye has ranged from 300 to 380 mm (11.8 to 15.0 in); while the weighted mean length at capture of age-4 walleye has ranged from 370 to 522 mm (14.6 to 20.6 in; Table 7). In 2011, the weighted mean total length at capture of age-3 walleye was 361 mm (14.2 in; Table 7. Mean Wr values of walleye captured in gill nets during 2011 ranged from 89-93 for all length categories (e.g., stock to quality) sampled with the mean Wr value of stock-length walleye being 90 (Table 1). No length-related trends in Wr were observed.

Other Species

Black bullhead: The mean frame net CPUE of stock-length black bullhead was 39.1 (Table 1) and within the management objective range (≤ 100 stock-length bullhead/net night). In 2011, the mean frame net CPUE of stock-length black bullhead was lower than CPUE values of 55.8 and 76.5 observed in 2009 and 2010 (Table 2); however relative abundance remained high.

Black bullheads in the frame net catch ranged in total length from 9 to 29 cm (3.5 to 11.4 in) with the majority being ≥ quality-length (230 mm; 9 in). The PSD was 81 and the PSD-P was 0 (Table 1; Table 3). No age and growth information was collected in 2011. Stock-length black bullheads captured in the 2011 frame net catch had mean Wr values of 84 for each length category (e.g., stock to quality) sampled (Table 1).

Channel catfish: In 2011, 17 stock-length channel catfish that ranged in total length from 30 to 64 cm (11.8 to 25.2 in) were captured in frame nets, which resulted in a mean CPUE of 0.9 (Table 1). Since 2003, the frame net mean CPUE has ranged from a low of 0.5 (2004) to a high of 4.2 (2007; Table 2).

Few inferences can made concerning the size structure, growth, and condition of channel catfish due to low sample size. Although sample size was low, the majority of channel catfish sampled were in the stock-quality and quality-preferred length categories which had mean Wr values of 86 and 83, respectively.

White bass: White bass were first sampled in Richmond Lake during 2000 and have become well established (Table 2). Since 2003, mean frame net CPUE values have ranged from a low of 2.7 (2005) to a high of 59.7 (2006; Table 2). In 2011, white bass were the third most abundant species in the frame net catch with a mean frame net CPUE of 17.6 (Table 1).

Frame net captured white bass ranged in total length from 19 to 36 cm (7.5 to 14.2 in), had a PSD of 80 and a PSD-P of 50 (Table 1; Figure 8). Age estimates obtained from otoliths indicated the presence of six year classes (2005-2010; Table 9). Year classes produced in 2005 and 2010 were the most represented and collectively comprised 70% of white bass in the frame net catch. Peaks in white bass relative

abundance are tied closely to sporadic strong recruitment events (e.g., 2005 and 2010; Table 2; Table 9).

Since 2009, the weighted mean total length at capture of age-3 white bass sampled in the frame net catch has varied from 290 to 325 mm (11.4 to 12.8 in); while the weighted mean total length at capture of age-4 white bass has varied from 291 to 344 mm (11.5 to 13.5 in; Table 10). Frame net sampled white bass had mean Wr values $\geq$ 90 for all length categories (e.g., stock to quality) sampled with the mean Wr of stock-length white bass being 91 (Table 1). No length-related trends in white bass condition were observed.

Yellow perch: The mean gill net CPUE of stock-length yellow perch was 5.3 (Table 1) and indicated low relative abundance. Since 2003, mean gill net CPUE values of stock-length yellow perch have fluctuated from a low of 0.6 (2006) to a high of 10.7 (2010; Table 2). Hubers (2002) suggested that low relative abundance since the inception of annual surveys indicates that the yellow perch population may be limited by habitat characteristics in Richmond Lake.

Other: Common carp, northern pike, pumpkinseed, smallmouth bass, and white sucker were other fish species captured in low numbers during the 2011 survey (Table 1).

Management Recommendations

1) Conduct fish community assessment surveys on an annual basis (next survey scheduled in summer 2012) to monitor fish relative abundance, fish population size structure, fish growth, and stocking success.

2) Collect otoliths from black crappie, bluegill, and walleye to assess the age structure and growth rates of each population.

3) Stock large fingerling walleyes (≈25 walleye/acre) if gill netting results warrant (i.e., low gill net CPUE of < 250 mm (10 inch) walleye). The walleye population in Richmond Lake should be maintained at a high-density (i.e., a gill net mean CPUE of approximately 20 stock-length walleye/net-night) to effectively impact black crappie and bluegill size structures through predation.

4) Maintain the 381-mm (15 in) minimum length limit on walleye to benefit the population and comply with tool box options (Lucchesi and Blackwell 2009).

5) Maintain the 381-mm (15 in) minimum length limit on largemouth and smallmouth bass to benefit population and comply with tool box options (Blackwell and Lucchesi 2009).

Table 1. Mean catch rate (CPUE; gill/frame nets= catch/net night, electrofishing= catch/hour) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) of stock-length fish for various fish species captured in experimental gill nets, frame nets, and electrofishing in Richmond Lake, 2011. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; CCF= channel catfish; COC= common carp; NOP= northern pike; PUS= pumpkinseed; SMB= smallmouth bass; WAE= walleye; WHB= white bass; WHS= white sucker; YEP= yellow perch

	Abundance		Stock Density Indices				Condition	
Species	CPUE	CI-80	PSD	CI-90	PSD-P	CI-90	Wr	CI-90
Frame nets								
BLB	39.1	21.2	81	2	0	---	84	1
BLC	5.9	2.4	23	7	2	2	99	1
BLG	60.7	18.8	89	2	6	1	110	<1
CCF	0.9	0.7	65	21	6	10	84	3
COC	0.1	0.1	100	0	100	0	95	20
NOP	0.6	0.3	55	29	18	22	80	6
PUS	0.1	<0.1	0	---	0	---	87	---
SMB	0.1	<0.1	---	---	---	---	---	---
WAE	2.2	0.9	25	12	0	---	85	1
WHB	17.6	6.2	80	4	50	5	91	<1
WHS	0.1	<0.1	100	---	100	---	93	---
YEP	0.9	0.4	50	23	5	8	87	2
Gill nets								
BLB	24.7	11.2	34	6	0	---	97	<1
BLC	0.2	0.2	0	---	0	---	114	---
BLG	0.5	0.7	0	---	0	---	113	5
CCF	2.2	1.3	100	0	0	---	83	4
COC	0.2	0.2	100	---	100	---	85	---
NOP	0.7	0.7	100	0	0	---	83	4
WAE	8.3	4.1	30	11	2	3	90	1
WHB	1.2	1.1	86	28	29	36	96	9
YEP	5.3	2.3	31	14	3	5	97	2
Electrofishing								
WAE [1,2] (age-0)	34.0	---	---	---	---	---	---	---

[1] Fall night electrofishing.
[2] Catch rate (CPUE) represents age-0 walleye/hour

Table 2. Historic mean catch rate (CPUE; gill/frame nets= catch/net night, electrofishing= catch/hour) of stock-length fish for various fish species captured in experimental gill nets, frame nets, and electrofishing in Richmond Lake, 2003-2011. BLB= black bullhead; BLC= black crappie; BLG= bluegill; CCF= channel catfish; COC= common carp; LMB= largemouth bass; NOP= northern pike; PUS= pumpkinseed; ROB= rock bass; SMB= smallmouth bass; WAE= walleye; WHB= white bass; WHS= white sucker; YEP= yellow perch

	CPUE								
Species	2003	2004	2005	2006[2]	2007[2]	2008	2009	2010	2011
Frame nets									
BLB	21.2	22.3	2.1	2.8	19.2	1.5	55.8	76.5	39.1
BLC	24.1	10.5	40.3	64.3	127.2	101.7	58.0	0.7	5.9
BLG	41.3	55.4	23.8	46.9	43.9	35.2	29.7	60.2	60.7
CCF	1.9	0.5	0.9	2.1	4.2	1.9	2.2	2.1	0.9
COC	0.4	0.5	3.3	0.9	1.3	1.9	0.4	0.4	0.1
LMB	0.1	0.1	0.0	0.2	0.0	0.3	0.0	0.1	0.0
NOP	0.6	0.1	0.3	0.3	0.2	0.3	0.1	0.7	0.6
PUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ROB	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
SMB	0.7	0.5	1.4	1.4	0.6	0.8	0.5	1.0	0.1
WAE	8.6	13.4	2.6	13.5	1.5	0.7	1.1	1.5	2.2
WHB	5.8	5.5	2.7	59.7	28.1	14.1	8.1	6.1	17.6
WHS	0.9	1.1	0.5	1.4	0.8	0.2	0.2	0.1	0.1
YEP	0.7	0.1	0.3	0.0	0.2	0.4	0.6	0.2	0.9
Gill nets									
BLB	18.7	2.0	1.3	4.0	6.3	3.5	11.0	12.5	24.7
BLC	1.3	0.8	4.7	18.4	27.2	61.3	13.0	0.2	0.2
BLG	1.5	1.0	0.7	1.0	0.2	0.3	0.3	1.5	0.5
CCF	0.3	0.5	0.7	1.6	2.7	2.5	2.2	1.3	2.2
COC	0.2	1.8	0.8	7.6	5.5	2.0	0.5	0.3	0.2
NOP	0.5	0.0	0.0	0.0	0.0	0.3	0.2	3.7	0.7
WAE	26.2	25.8	10.8	18.0	2.7	1.5	2.3	5.2	8.3
WHB	2.3	1.5	4.0	29.0	10.2	10.5	2.8	1.3	1.2
WHS	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0
YEP	7.5	3.8	4.5	0.6	0.8	4.8	3.5	10.7	5.3
Electrofishing									
WAE [1]	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	34.0

[1] Fall night electrofishing; catch rate (CPUE) represents age-0 walleye/hour

[2] Monofilament gill net mesh size change (0.75”, 1.00”, 1.25”, 1.50”, 2.00” and 2.50”)

Table 3. Mean catch rate (CPUE; gill/frame nets= catch/net night), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and relative weight (Wr) for selected species captured in experimental gill nets and frame nets in Richmond Lake, 2003-2011. BLB= black bullhead; BLC= black crappie; BLG= bluegill; WAE= walleye

Species	2003	2004	2005	2006[1]	2007[1]	2008	2009	2010	2011	Objective
Frame nets										
BLB										
CPUE	21	22	2	3	19	2	56	77	39	≤ 100
PSD	100	99	97	61	23	93	18	55	81	---
PSD-P	28	30	79	41	1	0	0	1	0	---
Wr	84	89	84	86	78	89	84	84	84	---
BLC										
CPUE	24	10	40	64	127	102	58	1	6	≥ 10
PSD	100	76	83	11	13	88	93	67	23	30-60
PSD-P	43	66	13	2	2	2	0	8	2	5-10
Wr	106	107	117	110	95	106	102	104	99	
BLG										
CPUE	41	55	24	47	44	35	30	60	61	≥ 25
PSD	99	36	75	82	90	94	82	91	89	30-60
PSD-P	47	24	47	22	2	2	19	5	6	5-10
Wr	117	108	119	106	102	119	113	117	110	---
Gill nets										
WAE										
CPUE	26	26	11	18	3	2	2	5	8	≥ 20
PSD	13	24	32	34	81	67	7	10	30	10-40
PSD-P	1	1	3	3	44	11	0	0	2	< 5
Wr	90	88	90	83	78	83	88	89	90	---

[1] Monofilament gill net mesh size change (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

Table 4. Year class distribution based on the expanded age/length summary for bluegill sampled in frame nets from Richmond Lake, 2007-2011.

	Year Class												
Survey Year	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
2011		70	246	656	73	25	20						
2010	---			928	109		47						
2009	---	---		62	258	50	162			2			
2008	---	---	---		32	3	590	7					
2007	---	---	---	---			620	95	55	6	3	10	4

Table 5. Weighted mean total length (mm) at capture for bluegill sampled in frame nets (expanded sample size) from Richmond Lake, 2007-2011.

	Age							
Year	1	2	3	4	5	6	7	8
2011	118 (70)	158 (246)	182 (656)	198 (73)	213 (25)	215 (20)	---	---
2010	---	161 (928)	189 (109)	---	215 (47)	---	---	---
2009	90 (62)	160 (258)	194 (50)	200 (162)	---	---	227 (2)	---
2008	100 (32)	148 (3)	179 (590)	201 (7)	---	---	---	---
2007	---	157 (620)	169 (95)	181 (55)	194 (6)	214 (3)	226 (10)	234 (4)

Table 6. Year class distribution based on the expanded age/length summary for walleye sampled in gill nets and associated stocking history (Number stocked x 1,000) from Richmond Lake, 2007-2011.

	Year Class													
Survey Year	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
2011	2	8		37	7	2						1		
2010	---			17	11	3								
2009	---	---		14	7	6								
2008	---	---	---		3	3		3		1	1	1	1	
2007[1]	---	---	---	---		3	1	5	1		1	4		1
# stocked														
fry														
sm. fingerling														
lg. fingerling	15[2]	12		4	12	24		33			61	9		6

[1] Monofilament gill net mesh size change (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")
[2] Completed after 2011 fish community survey

Table 7. Weighted mean total length (mm) at capture for walleye age-1 through age-10 sampled in experimental gill nets (expanded sample size) from Richmond Lake, 2005-2011. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

	Age										
Year	0	1	2	3	4	5	6	7	8	9	10
2011[1]	129(2)	249(8)	---	361(37)	381(7)	424(2)	---	---	---	---	---
2010	---	---	305(17)	338(11)	370(3)	---	---	---	---	---	---
2009	---	233(14)	263(7)	318(6)	---	---	---	---	---	---	---
2008	---	203(3)	247(3)	---	404(3)	---	432(1)	480(1)	624(1)	495(1)	---
2007[1]	---	205(3)	455(1)	380(5)	522(1)	---	542(1)	493(4)	---	521(1)	---
2006	---		329(60)	427(1)	411(3)	427(17)	470(7)	634(1)	593(1)	---	---
2005[1]	---	245(47)	---	300(1)	375(39)	434(4)	---	564(1)	495(1)	---	---

[1] Older walleye were sampled, but are not reported in this table

Table 8. Stocking history including size and number for fishes stocked into Richmond Lake, 1998-2011. SXW= saugeye; CCF= channel catfish; WAE= walleye

Year	Species	Size	Number
1998	SXW	large fingerling	6,030
2000	CCF	large fingerling	25,000
	WAE	large fingerling	9,285
2001	WAE	large fingerling	60,984
2004	WAE	large fingerling	32,535
2006	WAE	large fingerling	23,828
2007	WAE	large fingerling	11,766
2008	WAE	large fingerling	4,218
2010	WAE	large fingerling	11,788
2011	WAE	large fingerling	15,240

Table 9. Year class distribution based on the expanded age/length summary for white bass sampled in frame nets from Richmond Lake, 2009-2011.

	Year Class							
Survey Year	2011	2010	2009	2008	2007	2006	2005	2004
2011		118	60	14	13	6	105	
2010	---	4	30	10	15	11	42	
2009	---	---			1	24	113	7

Table 10. Weighted mean total length (mm) at capture for white bass sampled in frame nets (expanded sample size) from Richmond Lake, 2009-2011.

	Age						
Year	0	1	2	3	4	5	6
2011	---	227 (118)	290 (60)	325 (14)	344 (13)	347 (6)	339 (105)
2010	114 (4)	228 (30)	286 (10)	312 (15)	318 (11)	313 (42)	---
2009	---	---	268 (1)	290 (24)	291 (113)	301 (7)	---

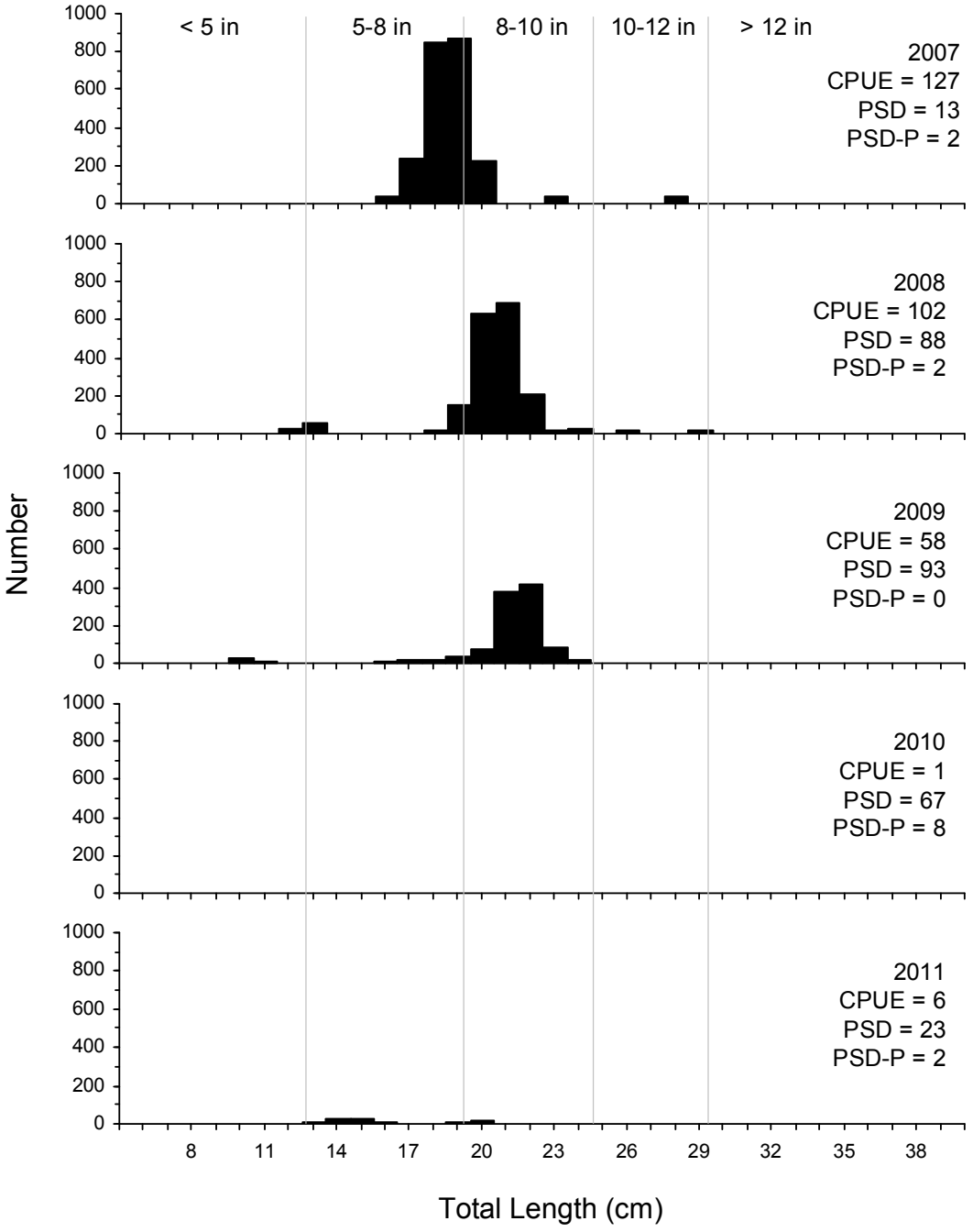

Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black crappie captured using frame nets in Richmond Lake, 2007-2011.

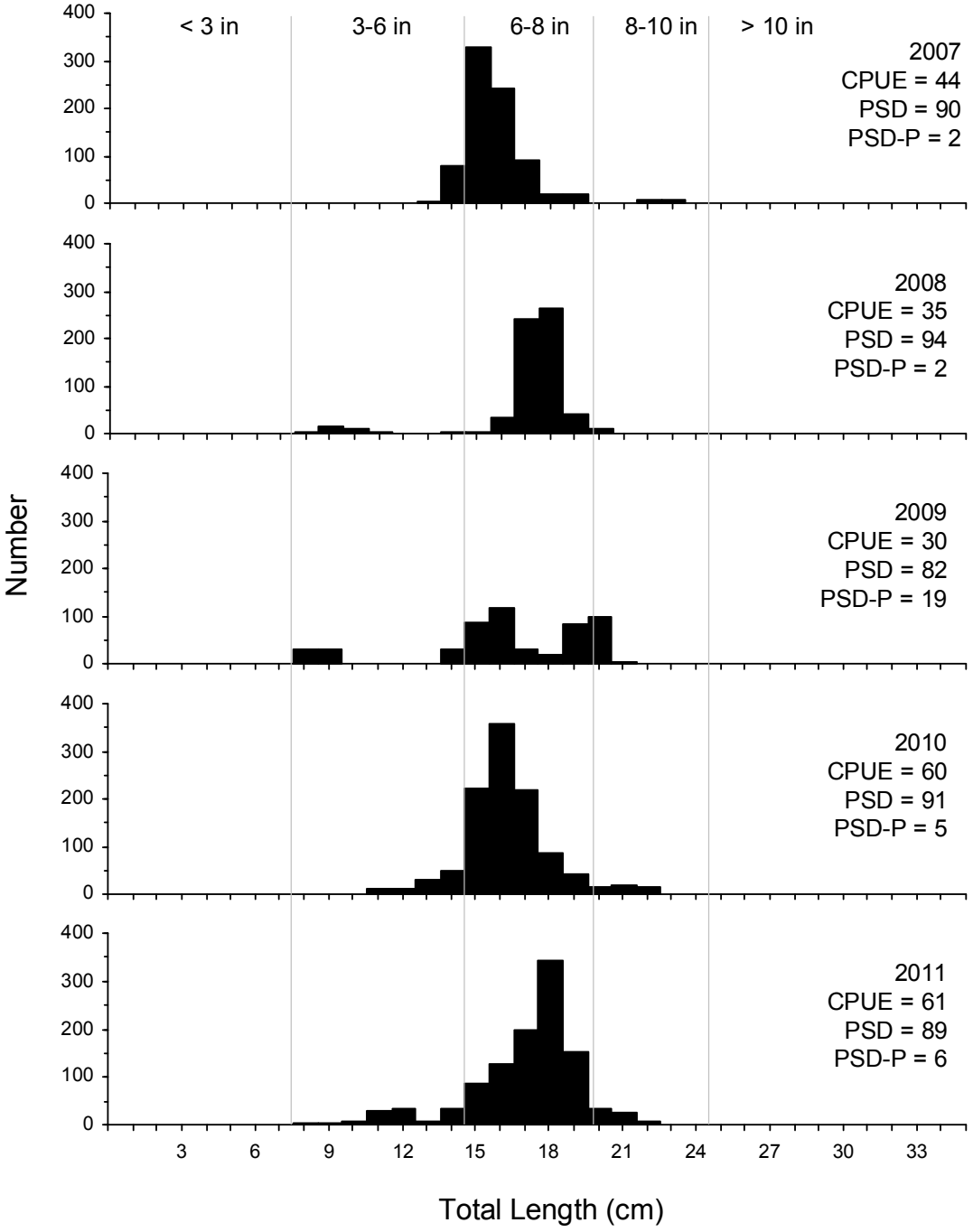

Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for bluegill captured using frame nets in Richmond Lake, 2007-2011.

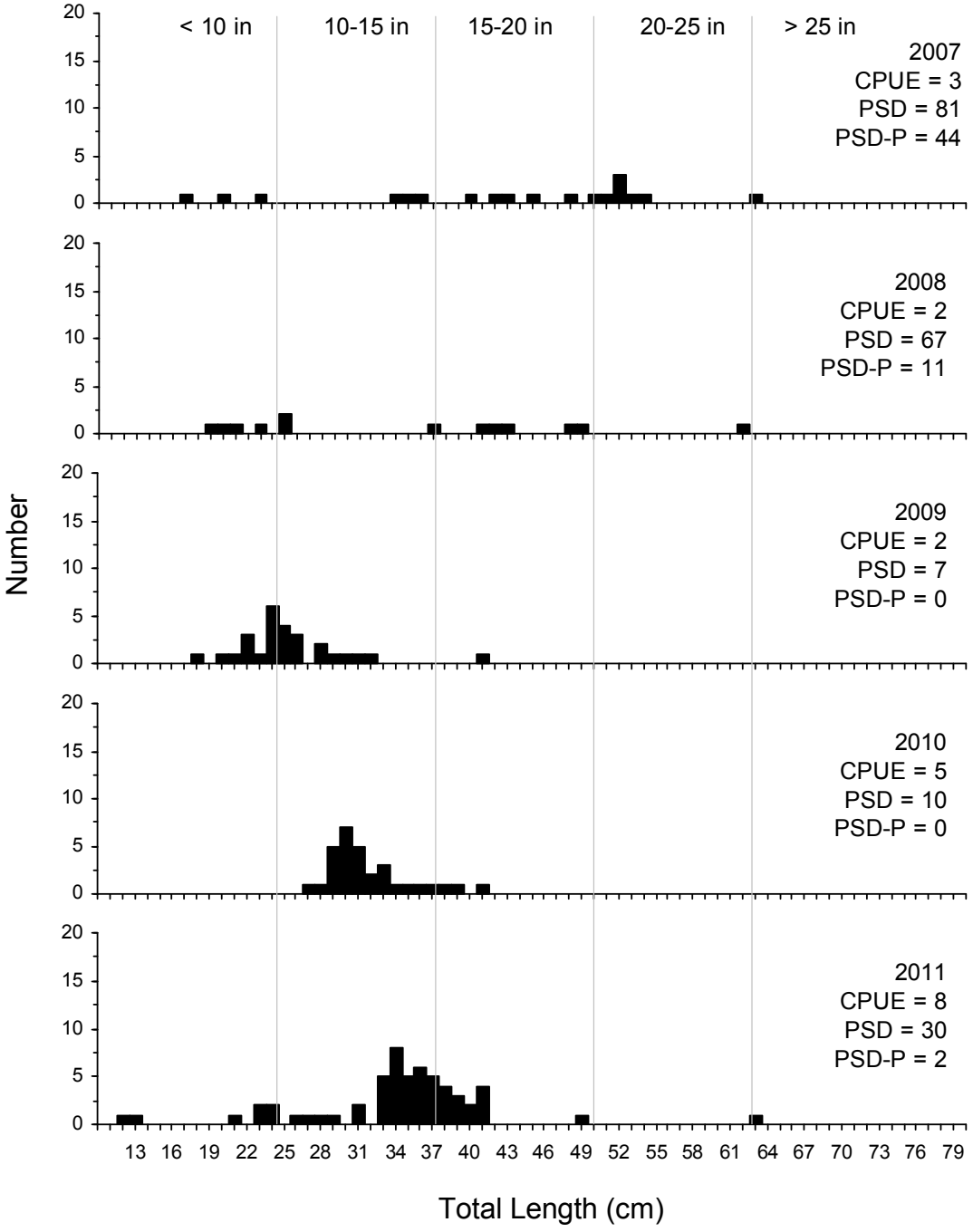

Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in Richmond Lake, 2007-2011.

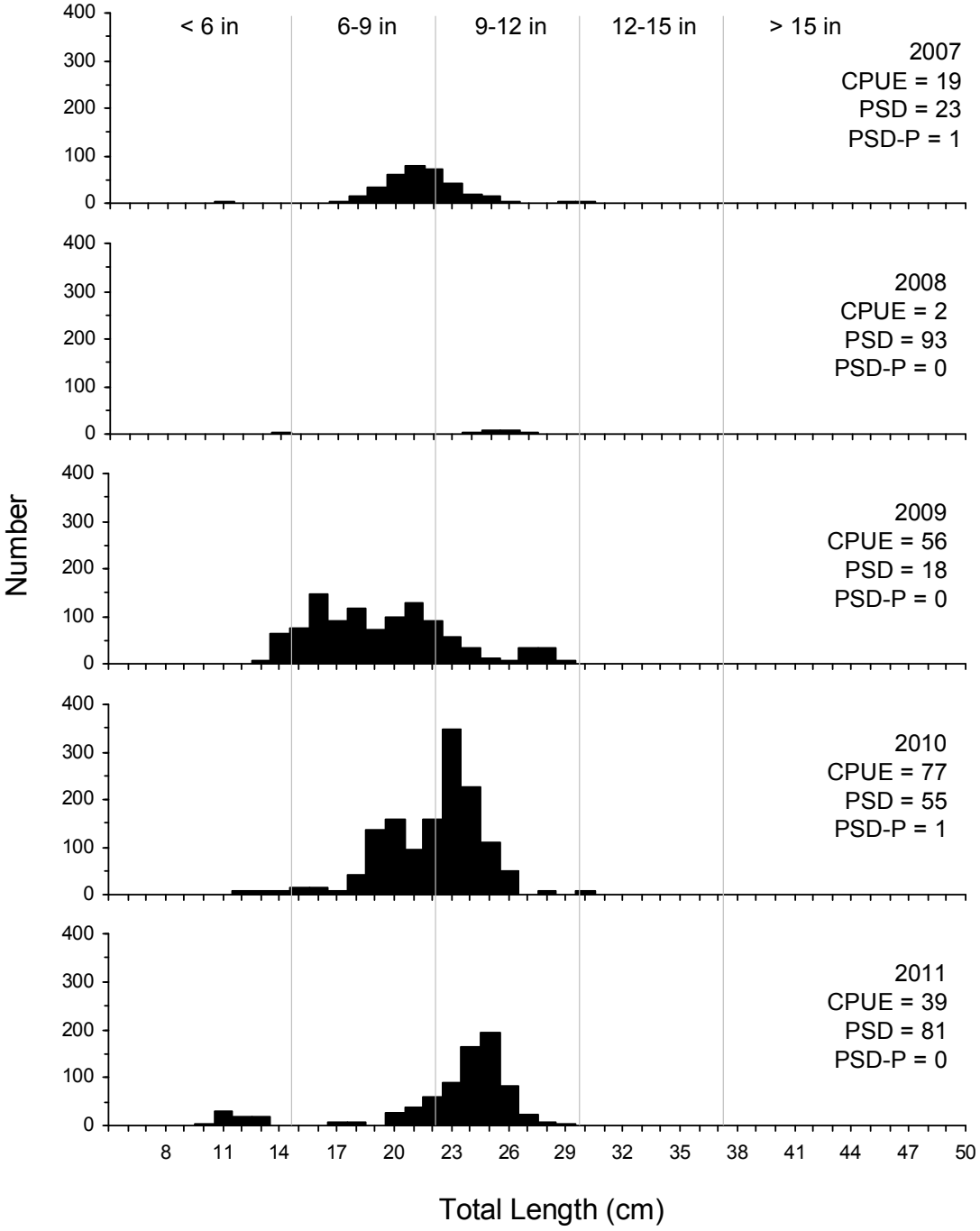

Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured using frame nets in Richmond Lake, 2007-2011.

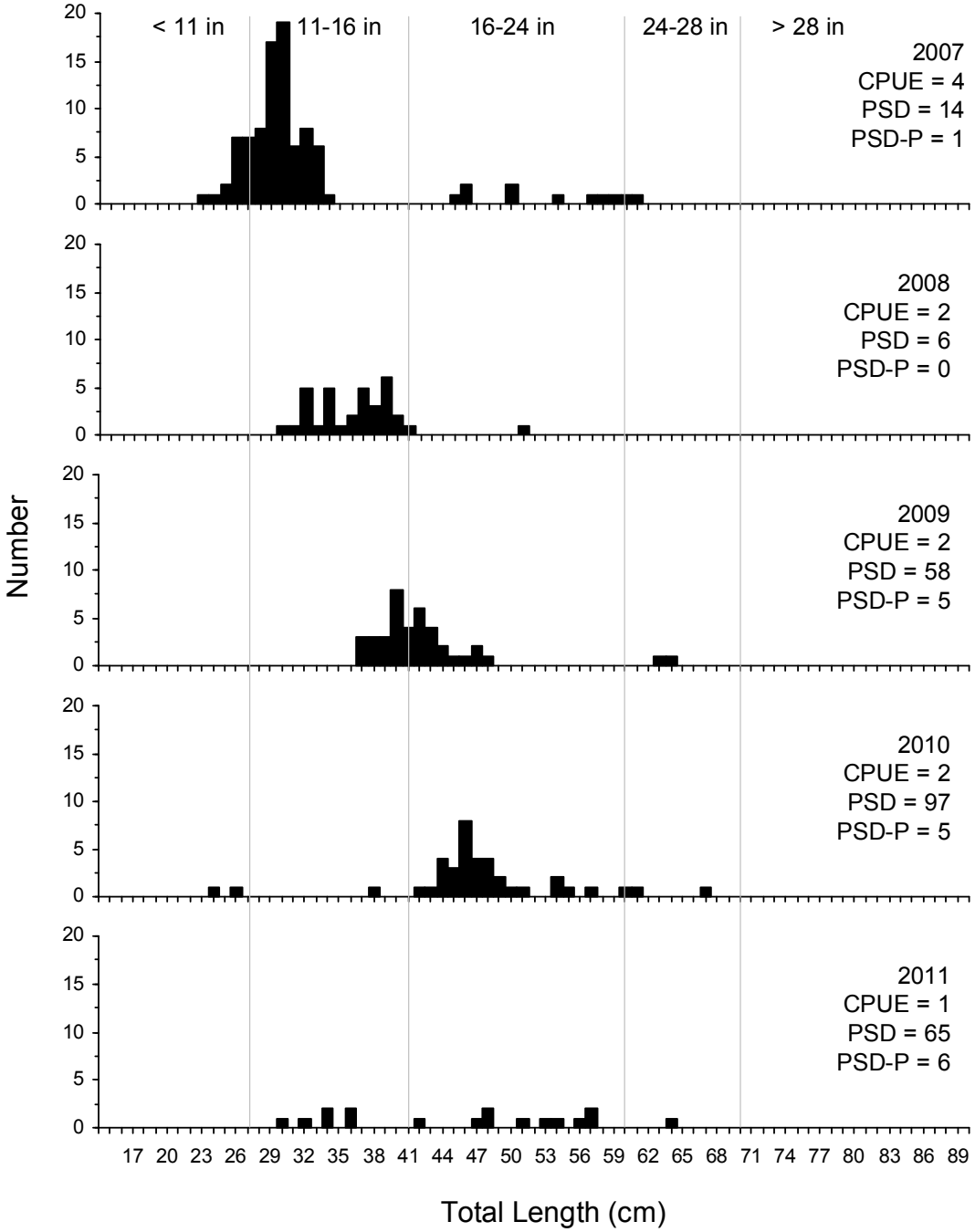

Figure 7. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for channel catfish captured using frame nets in Richmond Lake, 2007-2011.

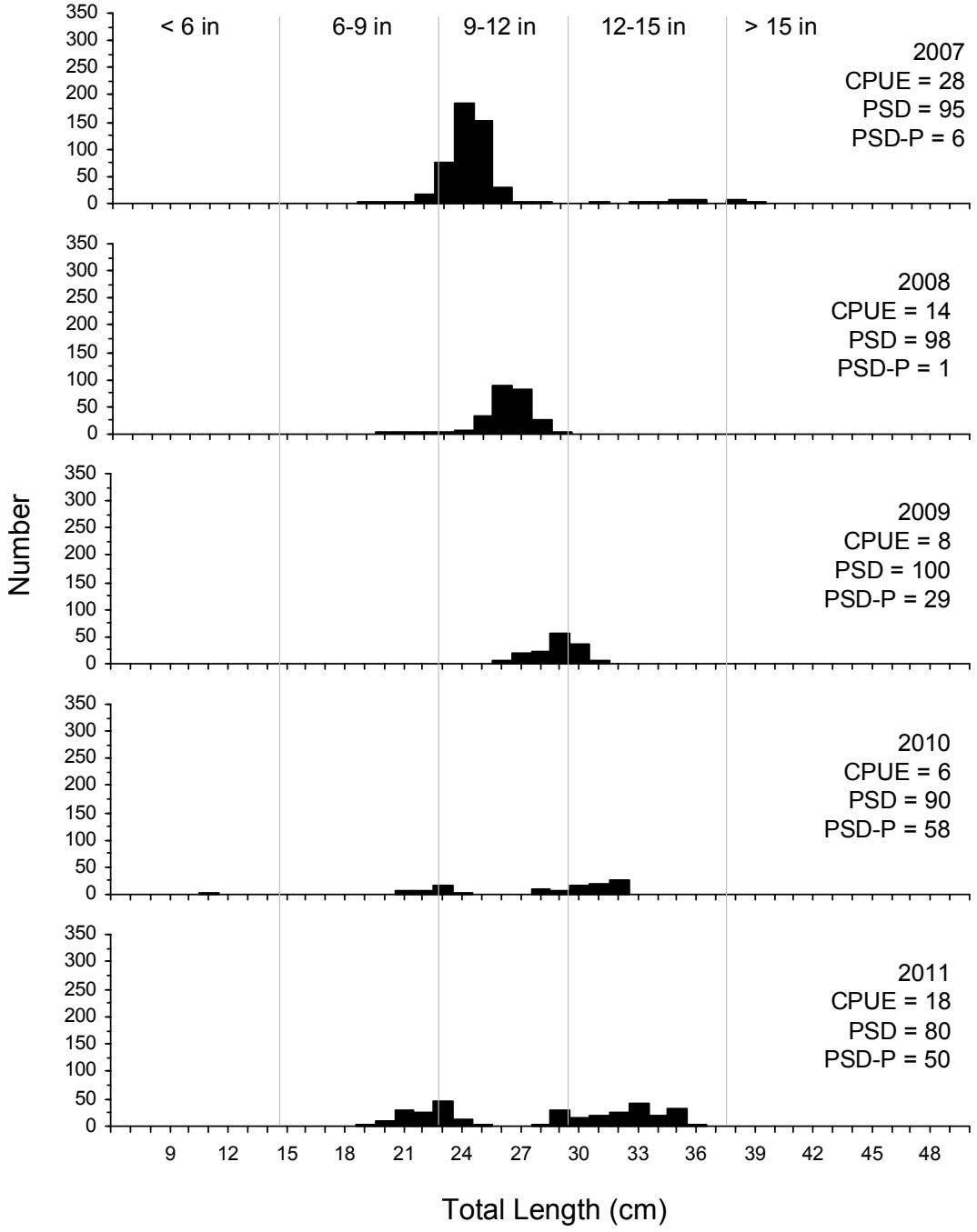

Figure 8. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for white bass captured using frame nets in Richmond Lake, 2007-2011.